Characterization of Growth, Glomerular Number, and Tubular Proteins in the Developing Rhesus Monkey Kidney.

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Public Summary:
These studies assessed kidney size and weight during development and utilized stereological methods to quantitate total number of glomeruli and immunohistochemical methods were included to identify patterns of expression of tubular proteins. Results indicate that glomerular number increased linearly with kidney weight, from the late first trimester to near term. The ratio of glomeruli to body weight tripled from the late first to early second trimester then remained relatively unchanged. These findings provide quantitative information on normal kidney ontogeny which is important for understanding new ways to treat congenital disorders of the kidney that can be identified prenatally.

Scientific Abstract:
An essential step in the translation of cell-based therapies for kidney repair involves preclinical studies in relevant animal models. Regenerative therapies in children with congenital kidney disease may provide benefit, but limited quantitative data on normal development is available to aid in identifying efficient protocols for repair. Nonhuman primates share many developmental similarities with humans and provide an important translational model for understanding nephrogenesis and morphological changes across gestation. These studies assessed monkey kidney size and weight during development and utilized stereological methods to quantitate total number of glomeruli. Immunohistochemical methods were included to identify patterns of expression of tubular proteins including Aquaporin-1 (AQP1), AQP2, Calbindin, E-Cadherin, and Uromodulin. Results have shown that glomerular number increased linearly with kidney weight, from 1.1 x 103 in the late first trimester to 3.5 x 105 near term ($P < 0.001$). The ratio of glomeruli to body weight tripled from the late first to early second trimester then remained relatively unchanged. Only AQP1 was expressed in the proximal tubule and descending Loop of Henle. The ascending Loop of Henle was positive for AQP2, Calbindin, and Uromodulin; distal convoluted tubules stained for Calbindin only; and collecting tubules expressed AQP2 and E-Cadherin with occasional Calbindin-positive cells. These findings provide quantitative information on normal kidney ontogeny in rhesus monkeys and further support the importance of this model for human kidney development. Anat Rec, 2013. (c) 2013 Wiley Periodicals, Inc.